vegetation zones quite clearly. Thus, samples 8–10 correspond to the Ponderosa pine (*Pinus ponderosa*) zone; samples 11–14 correspond to the Western juniper (*Juniperus occidentalis*) zone; samples 15–18 correspond to the Grand fir (*Abies grandis*) zone east of the Cascades; samples 19–28 correspond to the Pacific silver fir (*Abies amabilis*) zone above an elevation of 1000 meters and the Western Hemlock (*Tsuga heterophylla*) zone west of the Cascades; samples 29–34 correspond to the Willamette Forest and Prairie zones; and samples 35–39 correspond to the Sitka spruce (*Picea sitchensis*) zone. This high correspondence of pollen and vegetation illustrates that pollen is a strong predictor of vegetation. Using results from the OTTER Project (Oregon Transect Ecosystem Research Project), and assuming a linear relation between pollen variables and vegetation indices, a model was produced; the improved model can be used to reconstruct past environments in order to create vegetation indices from fossil pollen data (i.e., "hindcasting").

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Global Land Surface Monitoring with Low-Resolution Satellite Imagery

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The only practical way to produce maps of large regions of the globe is to use remotely sensed data that have coarse spatial resolution, such as data from the advanced very-high-resolution radiometer (AVHRR) at 1.1-kilometer resolution, or the soon-to-be launched moderate-resolution imaging spectroradiometer (MODIS) instrument at resolutions of 250 meters to 1 kilometer (MODIS is a "moderate-resolution" instrument by today's standards). However, the accuracy of the resultant maps is in doubt, especially for mapping highly fragmented land-cover types such as burn scars in forests and grasslands and ponds in Arctic tundra. These land-cover types are important in climatology, hydrology, and other Earth sciences. The objective of this project is to develop an approach for improving area estimates by modeling the distribution of patch sizes of homogeneous land cover, such as open water or the ash layer left by fire.

Digital maps of fire scars in Brazil from both the Landsat multispectral scanner imagery (56-meter resolution) and AVHRR imagery and of water bodies in Alaskan tundra from the Earth Resources Satellite ERS-1 synthetic aperture radar imagery (at resolutions of 12.5 and 100 meters) have been developed. Statistical analysis has confirmed the important contribution of small patches to the overall extent of these land-cover types and has identified candidate models, exponential or power curves, for the fine-scale distributions. Comparison of Landsat and AVHRR maps revealed the types of pixelation effects, caused by low spatial resolution, that can cause errors in area measurements. Software to simulate patch-size distributions at various resolutions has been created and will be used to investigate the relationships between size distributions observed at different resolutions and to develop a new procedure for improving area estimates. Gerry Livingston, School of Natural Resources, University of Vermont, was a co-investigator on this project.

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